

### **ABSTRACT OF THE DISCLOSURE**

Neuroelectronic devices are disclosed which use charge-coupled detector array devices to stimulate, monitor and record neural network activity and response. The method and apparatus described herein uses vacuum-arc-plasma based methods of surface modification as a tool for forming large patterned neuronal arrays on substrates. The basic device features a charge coupled detector device array (CCD) having a thin protective film over the CCD, a thin patterned film to promote neuron growth, and an insulator. Methods for stimulating and monitoring stimulated and spontaneous electrical activity in individual neurons of the array can be carried out by the apparatus described.